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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/570,802	03/06/2006	Masaki Takaoka	12844100USWO	4876
52835 7590 08/14/2009 HAMRE, SCHUMANN, MUELLER & LARSON, P.C. P.O. BOX 2902 MINNEAPOLIS, MN 55402-0902				
EXAMINER ALEJANDRO, RAYMOND				
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/570,802

Applicant(s)

TAKAOKA, MASAKI

Examiner

Raymond Alejandro

Art Unit

1795

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03/06/06.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 16 October 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/ISD)
- 4) ☐ Interview Summary (PTO-413)
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____
- Paper No(s)/Mail Date 03/06/06

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on 03/06/06 was considered by the examiner.

Drawings

3. The drawings were received on 10/16/06. These drawings are acceptable.

Specification

4. The preliminary amendment filed 03/06/06 does not introduce new matter into the disclosure.
5. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.
6. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

Claim Objections

7. Claim 5 is objected to because of the following informalities: capital letters in the recitation "A step..." in lines 2, 4 and 8 (three occurrences) should be replaced with lower case letters. Appropriate correction is required.

Claim Rejections - 35 USC § 112

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claims 1-8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

10. Claim 1 is rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are: the issue here is related to the final structure of the claimed fuel cell and that ALL of the claimed elements are porous. For instance, the porous electrically-conductive material used as the substrate; the mesoporous thin film...having pores; and the porous electrically conductive material layer. Accordingly, depositing a material, layer, substance or film on another material does not necessarily produces a layered structure as instantly claimed. Further, in particular respect to "the porous electrically conductive material

layer", given that the substrate is porous, and the membrane is also porous, it is uncertain what would be its specific location in the claimed structure if any, and where such a layer is deposited, over what? Therefore, the final or resulting structure of the claimed invention is not confusing and indefinite.

11. Claim 5 is rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps. See MPEP § 2172.01. The omitted steps are: the issue here is related to the steps of the method of producing and that ALL of the claimed elements made by the claimed method are porous. For instance, the porous electrically-conductive material used as the substrate; the mesoporous thin film...having pores; and the porous electrically conductive material layer. Accordingly, depositing a material, layer, substance or film on another material does not necessarily produces a layered structure as instantly claimed. Further, in particular respect to "the porous electrically conductive material layer", given that the substrate is porous, and the membrane is also porous, it is uncertain what would be its specific location in the claimed structure if any, and where or how such a layer is deposited, over what? Therefore, the final or resulting structure of the claimed invention is not confusing and indefinite.

12. Claim 4 recites the limitation "the anodization of silicon" in line 3. There is insufficient antecedent basis for this limitation in the claim.

13. Claim 7 recites the limitation "the anodization step" in line 2. There is insufficient antecedent basis for this limitation in the claim. Note that claim 6 merely recites "*a step of anodizing the surface ...*".

14. Claim 7 recites the limitation "the fuel cell forming region" in lines 2-3. There is insufficient antecedent basis for this limitation in the claim.
15. The term "desired thickness" in claim 7 is a relative term which renders the claim indefinite. The term "desired thickness" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. The specific magnitude or dimension of it is totally unknown, subjective and open to interpretation.
16. Claim 8 recites the limitation "the back side thereof" in line 3. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

17. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

18. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

19. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

20. Claims 1-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maynard et al 6541149 in view of Mikhailenko et al publication "*Solid electrolyte properties of sulfonic acid functionalized mesostructured porous silica*" (herein called Mikhailenko et al).

As to claims 1 and 5:

The disclosure of Maynard et al is concerned with fuel cells and processes for forming such fuel cells (Abstract/ COL 2, lines 28-35/EXAMPLES 1-2/ **CLAIM 1**).

Figures 2D and 3 of Maynard et al illustrate a fuel cell comprising a first porous silicon substrate acting as a current collector including a metallic catalyst layer (COL 3, line 37 to COL 4, line 53); on the substrate, there is deposited a proton exchange membrane 40 which can be ANY suitable material that allows ions to conduct across it (COL 4, lines 54-65); and thereon there is a second porous silicon substrate acting as a current collector including a metallic catalyst layer (COL 5, lines 14-25).

FIGURES 2A-2D and EXAMPLES 1-2 of Maynard et al show a sequence of steps for fabricating the fuel cell including forming a porous substrate which acts as a current collector (COL 3, line 37 to COL 4, line 53); depositing thereon an electrolyte membrane (COL 4, lines

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54-65); and further depositing another porous substrate which also acts as a current collector (COL 5, lines 14-25).

As to claim 3:

The electrolyte membrane element of Maynard et al has a thickness of at least 10 μm (COL 5, lines 1-5).

As to claim 4:

Maynard et al includes a porous substrate layer made of silicon (COL 3, line 37 to COL 4, line 53).

As to the method limitation, *i.e. the anodization of silicon*, it is noted that a method limitation incorporated into a product claim does not patentably distinguish the product because what is given patentably consideration is the product itself and not the manner in which the product was made. Therefore, the patentability of a product is independent of how it was made. As a result, the process steps of a product-by-process claim do not impart any significant property or structure to the claimed end product. And, if there is any difference, the difference would have been minor and obvious. Determination of patentability of a product-by-process claim is based on the scope of the product itself. *“[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product by process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.”*

In re Thorpe 777 F.2d 695, 698, 227 USPQ 964,966 (Fed Cir. 1985) and MPEP 2113.

As to claims 7-8:

The process of Maynard et al includes etching areas/regions of the fuel cell including the silicon substrate at any time, that is, prior to or after processing the silicon substrate (COL 2, lines 52-65/COL 4, lines 1-15/EXAMPLES 1-2). The silicon substrate is processed to a desired thickness (COL 3, lines 36-39).

Maynard et al discuss a fuel cell and a process for forming the same as set forth above. However, Maynard et al does not expressly disclose the specific protonically-conductive membrane.

As to claim 1-2:

Mikhailenko et al discloses that it is known in the art to use mesostructured templated porous silica functionalized with sulfonic acid groups (*Abstract/2.1 Synthesis of Sulfonic-functionalized mesoporous silica*) as an electrolyte proton conductor in a fuel cell (1. Introduction) as it shows excellent proton conduction properties (*Abstract*) and good mechanical and thermal resistance (1. *Introduction*). Such a mesostructured material is made of SiO₂ (*the silicon-oxygen bond*) (3.1 *TGA and Adsorption Analysis*). It is disclosed that mesoporous silica possesses a very large specific surface due to porous inner space and can be thought of as multi-tubular grains where charge transfer can occur (3.1 *TGA and Adsorption Analysis*). Note that the electrolyte material of Mikhailenko et al is disposed between two stainless steel piston used as electrodes (2.3 *Impedance Spectroscopy Measurements*). *It is also noted that in a mesoporous structure there is a set or array of aligned porous having uniform size or diameter. Thus, it can be said that such a mesoporous structure reads on applicant's limitation about having pores periodically aligned therein. Note that the term "periodically aligned" does not appear to*

constitute a particular micro-structure or arrangement other than having the pores aligned periodically.

In view of the above, it would have been obvious to a skilled artisan at the time the invention was made to use or make the specific protonically-conductive membrane of Mikhailenko et al in the fuel cell or process of making the fuel cell of Maynard et al as Mikhailenko et al teach that the disclosed protonically-conductive membrane shows excellent proton conduction properties (*Abstract*) and good mechanical and thermal resistance (*I. Introduction*). Thus, the functionalized meso-porous silica material used as a protonically-conductive membrane exhibits a high conductivity to make suitable as a solid electrolyte. Additionally, such a material is stable under humid conditions.

21. Claims 1-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maynard et al 6541149 in view of publication WO 02/037506 (*for purposes of rejections, its English language counterpart US 2004/0029015 to Inagaki et al is cited*).

As to claims 1 and 5:

The disclosure of Maynard et al is concerned with fuel cells and processes for forming such fuel cells (Abstract/ COL 2, lines 28-35/EXAMPLES 1-2/**CLAIM 1**).

Figures 2D and 3 of Maynard et al illustrate a fuel cell comprising a first porous silicon substrate acting as a current collector including a metallic catalyst layer (COL 3, line 37 to COL 4, line 53); on the substrate, there is deposited a proton exchange membrane 40 which can be ANY suitable material that allows ions to conduct across it (COL 4, lines 54-65); and thereon

there is a second porous silicon substrate acting as a current collector including a metallic catalyst layer (COL 5, lines 14-25).

FIGURES 2A-2D and EXAMPLES 1-2 of Maynard et al show a sequence of steps for fabricating the fuel cell including forming a porous substrate which acts as a current collector (COL 3, line 37 to COL 4, line 53); depositing thereon an electrolyte membrane (COL 4, lines 54-65); and further depositing another porous substrate which also acts as a current collector (COL 5, lines 14-25).

As to claim 3:

The electrolyte membrane element of Maynard et al has a thickness of at least 10 μm (COL 5, lines 1-5).

As to claim 4:

Maynard et al includes a porous substrate layer made of silicon (COL 3, line 37 to COL 4, line 53).

As to the method limitation, *i.e. the anodization of silicon*, it is noted that a method limitation incorporated into a product claim does not patentably distinguish the product because what is given patentably consideration is the product itself and not the manner in which the product was made. Therefore, the patentability of a product is independent of how it was made. As a result, the process steps of a product-by-process claim do not impart any significant property or structure to the claimed end product. And, if there is any difference, the difference would have been minor and obvious. Determination of patentability of a product-by-process claim is based on the scope of the product itself. “[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product

itself. The patentability of a product does not depend on its method of production. If the product in the product by process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process."

In re Thorpe 777 F.2d 695, 698, 227 USPQ 964,966 (Fed Cir. 1985) and MPEP 2113.

As to claims 7-8:

The process of Maynard et al includes etching areas/regions of the fuel cell including the silicon substrate at any time, that is, prior to or after processing the silicon substrate (COL 2, lines 52-65/COL 4, lines 1-15/EXAMPLES 1-2). The silicon substrate is processed to a desired thickness (COL 3, lines 36-39).

Maynard et al discuss a fuel cell and a process for forming the same as set forth above. However, Maynard et al does not expressly disclose the specific protonically-conductive membrane.

As to claim 1-2:

Inagaki et al disclose a solid electrolyte useful as an electrolytic membrane for fuel cells and which is composed of an organic/inorganic composite material having pores and having a skeleton comprising a metal atom and an oxygen atom and a functional group having an ion exchange function (Abstract/0002, 0005, 0011-0014, 0033-0035/EXAMPLES 1-3/ CLAIM 1). An skeleton comprising SiO₂ is disclosed (0059) and/or other metals (0082-0083). Specific examples of functional groups having an ion exchange function includes sulfonic acid groups, phosphoric acid groups, carboxylic acid groups, among others (0090-0091). Inagaki et al's solid electrolyte can be made into a thin film used as a solid electrolyte membrane (0092) and a process involving coating a substrate can be employed (0092). *In this case, it also noted that the*

porous solid electrolyte membrane film of Inagaki et al must include at least a set of patterned porous having uniform size or diameter based on the concept of mean-pore diameter disclosed by Inagaki et al (P0024-0028). Thus, it can be said that Inagaki et al's solid electrolyte porous structure reads on applicant's limitation about having pores periodically aligned therein. Note that the term "periodically aligned" does not appear to constitute a particular micro-structure or arrangement other than having the pores aligned periodically as implied by its plain meaning.

In view of the above, it would have been obvious to a skilled artisan at the time the invention was made to use or make the specific solid electrolyte of Inagaki et al in the fuel cell or process of making the fuel cell of Maynard et al as Inagaki et al teach that the disclosed solid electrolyte provides a sufficiently high ion conductivity at a lower temperature than with a conventional solid electrolyte such as stabilized zirconia. Additionally, such a material is easy to process into thin films, thereby providing good contact with electrodes.

22. Claims 6-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over: a) Maynard et al 6541149 in view of Mikhailenko et al publication "*Solid electrolyte properties of sulfonic acid functionalized mesostructured porous silica*" (herein called Mikhailenko et al); and/or b) Maynard et al 6541149 in view of publication WO 02/037506 (*for purposes of rejections, its English language counterpart US 2004/0029015 to Inagaki et al is cited*) as applied to claim 5 above, and further in view of Ohlsen et al 2002/0028372.

Maynard et al, Mikhailenko et al and Inagaki et al are applied, argued and incorporated herein for the reasons discussed above.

In addition, it is noted that the process of Maynard et al includes etching areas/regions of the fuel cell including the silicon substrate at any time, that is, prior to or after processing the silicon substrate (COL 2, lines 52-65/COL 4, lines 1-15/EXAMPLES 1-2). The silicon substrate is processed to a desired thickness (COL 3, lines 36-39).

However, none of the preceding references expressly disclose the specific anodizing step.

Ohlsen et al disclose fuel cell structures and fuel cell electrodes structures (Abstract/Title) including silicon wafer/substrate used as a support structure for carrying a catalyst wherein the porous silicon substrates (and/or support structures) may be formed by chemical techniques such as anodic polarization of silicon (0070-0071, 0074, 0145, 0150, 0173, 0177).

In view of the above, it would have been obvious to a skilled artisan at the time the invention was made to make/treat the specific silicon substrate of Maynard et al, Mikhailenko et al and Inagaki et al by using the chemical technique of anodic polarization of silicon of Ohlsen et al as Ohlsen et al teach that it is known in the art to form porous silicon substrates by wet chemical techniques such as anodization which are employed by the semiconductor industry for wafer thinning, polishing and the manufacture of porous silicon films including a wide variety of thicknesses. Thus, the anodization techniques assists in creating a silicon substrate conforming to desired thickness and surface conditions.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Raymond Alejandro whose telephone number is (571) 272-1282. The examiner can normally be reached on Monday-Thursday (8:00 am - 6:30 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Raymond Alejandro/
Primary Examiner, Art Unit 1795